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COGNITIVE DEVELOPMENT IN INFANTS OF DIFFERENT AGE LEVELS AND FROM DIFFERENT ENVIRONMENTAL BACKGROUNDS.

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DO CHILDREN RAISED IN ENVIRONMENTS ASSOCIATED WITH LATER DEFICITS IN PSYCHOMETRIC INTELLIGENCE SHOW ANY DEFICITS DURING INFANCY AND, IF SO, WHEN DO SUCH DEFICITS APPEAR AND WHAT ABILITIES ARE AFFECTED. ARE THE ENVIRONMENTAL FACTORS ASSOCIATED WITH EARLY DEVELOPMENT OF INTELLIGENCE. FIFTY-ONE SLUM INFANTS AND A CONTROL GROUP OF 51 NON-SLUM INFANTS IN CHAMPAIGN-URBANA, ILLINOIS WERE TESTED IN THEIR 7TH, 11TH, 15TH, 18TH, AND 22ND MONTHS BY 3 SUB-SCALES OF THE INFANT PSYCHOLOGICAL DEVELOPMENT SCALE, AND 3 OTHER MEASURES OF DEVELOPMENT. IN ADDITION, EACH INFANT WAS HOME TESTED BY AN EXAMINER WHOSE NOTES WERE LATER TRANSLATED INTO A 4-POINT SCORING SYSTEM AND ADDED TO INFORMATION SUPPLIED BY THE INFANT'S MOTHER. DATA WERE ANALYZED USING THE SIGN TEST, AND THE RELATIONSHIP BETWEEN HOME STIMULATION AND DEVELOPMENTAL ITEMS WAS ANALYZED THROUGH POINT-BISERIAL CORRELATIONS. RESULTS INDICATED THAT SLUM INFANTS SHOW SLOWER DEVELOPMENT AT A MUCH EARLIER AGE THAN PREVIOUSLY SUSPECTED, SUGGESTING THAT COMPENSATORY PROGRAMS SHOULD START EARLIER THAN 3 YEARS OF AGE. IT ALSO APPEARS THAT, CONTRARY TO ACCEPTED HYPOTHESES, OVER-STIMULATION DURING INFANCY MAY BE MORE DETRIMENTAL THAN UNDER-STIMULATION AS AN ENVIRONMENTAL FACTOR. THIS PAPER WAS DELIVERED TO THE BIENNIAL MEETING OF THE SOCIETY FOR RESEARCH IN CHILD DEVELOPMENT IN NEW YORK, MARCH 29 - APRIL 1, 1967. (MS)

Cognitive Development in Infants of Different Age Levels and from Different Environmental Backgrounds*

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Cognitive development in infants of different age levels and from different environmental backgrounds

The study to be described in this paper is based on the increasing body of empirical evidence pointing to the importance of early environmental stimulation for the growth and development of many functions. It seems increasingly clear that early environmental stimulation is crucial not only for the growth and functioning of neural and bodily structures (Riesen, 1947; 1958; Haywood & Tapp, 1966) but also for the development of such complex processes as curiosity (Sackett & Cory, 1965), language (Brodbeck & Irwin, 1946; Irwin, 1948) and intelligence (Gilliland, 1949; Dennis & Najarian, 1957; Hunt, 1961; Fowler, 1962; Decarie, 1965). The early experience model followed in this paper (Hunt, 1961) postulates that the effects of early stimulation are to promote or retard the development of certain processes or functions that are crucial for all later development. These processes or functions may be described in terms of cell assemblies and phase sequences, in terms of accommodation and assimilation or in terms of the organism's information processing rate. Common to all these concepts is the point of view that inadequate environmental stimulation will retard the development of these processes which are the foundation for later development.

The hypothesis is perhaps most relevant for that segment of the population known as the "culturally deprived" - i.e., slum children, and children living in isolated rural communities. These individuals are reared from birth in supposedly unstimulating environments - though no one has yet clearly spelled out exactly what about the environment is unstimulating - who later on in life show clear deficits in psychometric intelligence and school performance. Although many studies have focused on the later functioning of these children, few if any have investigated their development during the years supposedly most crucial for their later development - early infancy. With this in mind, the present study set out to

investigate three questions:

(1) Will children reared in environments associated with later deficits in psychometric intelligence show any deficits during infancy?

(2) If early deficits are found, when during infancy will these deficits appear and what abilities will be most affected?

(3) What environmental factors are associated with the early development of intelligence?

Method

Subjects

The study was cross-sectional in nature, with the sample consisting of 102 infants at five different age levels. Infants were tested in the 7th, 11th, 15th, 18th and 22nd month of life. Half of the sample at each age level consisted of infants living in a slum area of Champaign-Urbana, Illinois. The infants in this sample (The Deprived Group) were obtained through the cooperation of public health and public aid workers who knew the families in this area. Quantitatively and qualitatively, these infants were living in homes that fell in the lowest measurable socio-economic category. As would be expected, the greatest number of these infants were Negro, however 16% of this sample was white. Although the N was too small for statistical test, it is worth noting that a survey of the developmental data revealed no apparent differences in development between deprived Negro infants and deprived white infants at any of the age levels surveyed.

Each infant in the deprived group was matched with a control infant on the basis of date of birth, sex, and age at testing. The names of the control infants were obtained from newspaper birth records and their parents were contacted individually. Over 75% of the parents contacted granted permission for us to see their child. The infants in the control group can be considered as a representative sample of non-slum youngsters in Champaign-Urbana.

As a further control, to screen out youngsters with gross motor deficits, all children in both groups were tested on gross motor development on an inventory based on the Gesell scales. All infants used in the study had to be functioning at age level or above on gross motor development. Three deprived children and one control child were dropped from the study for failure to meet this criterion.

Instruments

Infant abilities were measured in six different areas of development. Three of these abilities were evaluated by measuring each child on three sub-scales of the Infant Psychological Development Scale. Constructed by Uzgiris and Hunt (1966), this instrument is a developmental scale based on Piaget's model of intellectual development. Previous research on this scale has shown it to have high inter-observer and test-retest reliability. All the sub-scales have shown the high degree of ordinal scaling required by a Piaget type developmental measure. The sub-scales used in this study were: (1) Object permanence - a series of 14 tasks measuring the child's increasing development of mental representation of objects, as evidenced in the persistence of the child's search behavior for a hidden object; (2) Objects as means - five tasks measuring the child's ability to use objects, such as a support, a string, or a stick, as tools to obtain a goal object; (3) Schema development - which measures the frequency, variety and level of predominant behavior shown by the child toward objects. In addition to the sub-scales of the Infant Psychological Development Scale, three other measures, taken from previous research with infants, were utilized. These were: (1) Learning and Foresight - four tasks which measure the child's ability to come up with a solution to a problem without overt trial and error behavior, and his ability to learn new tasks; (2) Motor imitation - three tasks measuring the child's ability to imitate certain adult behaviors; (3) Verbal facility - measuring the amount and appropriateness of the child's verbal skills.

Home stimulation was measured by a 72 item inventory based on the Caldwell Inventory of home stimulation. About half of the inventory items were obtained through observation, the rest through direct questioning. All items in the inventory showed at least 75% inver-observer agreement.

Procedure

Each infant was tested in his own home over a two-three day period by the same examiner. To control for the possibility of bias in either scoring or administration of items, a second trained examiner was present as observer for 20% of the examinations at each age level. Mean inter-scorer agreement was quite high over all ages and tasks, the lowest percent agreement being in the mid 80s. Infants were tested only at times when they were neither sleepy nor hungry and in a cooperative mood.

During the testing session detailed notes were kept by the examiner on the performance of the child on each task. Immediately after testing these notes were transcribed onto special data sheets whereby the child's behavior on each task could be translated into a four point scoring system.[1] The observational section of the home stimulation scale was obtained during the testing session. The question section was obtained through a checklist interview of the mother after testing of the infant was completed.

Statistics

The developmental data were analyzed by means of the Sign Test (Siegel, 1956), a non-parametric matched pairs technique. The dependent variable was the level of behavior achieved on each sub-scale by the deprived infant versus the level achieved by the matched control infant. Significance was set at the .05 level. The relationship between home stimulation and development was analyzed through point-biserial correlations between each home stimulation item and each developmental item. For the resulting correlational matrices, a significant correlation was considered as one with a p. of less than .10, using a two-tailed test. Because of

the large matrices obtained, only those significant items that met a pre-determined criterion for frequency of occurrence and consistency of relationship were considered for later discussion.

Results

The results will be discussed separately for each specific ability. First, for object permanence, there are no significant differences between the groups at 7 months; by 11 months, there are clearly significant differences on visual object permanence, these differences favoring the controls. By 15 months these differences have vanished with the deprived group finally mastering this series of tasks. Neither group has as yet mastered the hidden displacement series of the object permanence scale. By 18 months, both groups have generally mastered the lower levels of hidden displacement. At 22 months, however, there is a trend (p. less than .10) for more of the controls to show superior performance at the highest levels of this series.

Second, for motor imitation, there are no significant differences between the groups at 7 months; by 11 months significent differences have appeared favoring the controls; by 15 months the controls are still superior, though these differences have shrunk to only a trend. After 15 months there are no significant differences between groups, probably due to a ceiling effect for this series. Third, in the learning and foresight tasks, for all practical purposes no infant in either group was able to begin to master these tasks until 15 months. At 15 months, the control group showed significantly more primitive foresight behavior in the appropriate tasks. By 18 months, the controls were showing significantly more actual foresight behavior as well as significantly better ability to learn a new task. These significant differences are again shown for the 22 month old subjects.

Fourth, for the objects as means scale, there are significant differences between the groups at 7 months of age if the child's motor ability to utilize an object effectively is taken into account. These differences favor the controls.

By 11 months these early differences have been confirmed, with the controls showing significantly better performance on the lowest level of this series. By 15 months both groups have progressed to the next highest level of performance on this series and show equal performance at this age level. By 18 months, however, the controls have moved ahead again, showing a significantly higher level of performance than the deprived infants. These significant differences favoring the controls are not only repeated but increased in the 22 month old groups.

Fifth, in terms of schemas, the controls show more advanced schemas and more socially appropriate behaviors at an earlier age than do the deprived subjects. These differences, while quite consistent, do not reach significance, however. Finally, on the verbalization measures, the controls show significantly more babbling and use of semi-words at 15 months of age. Between 15 and 22 months both groups show a great increase in vocabulary, both in terms of number of words and accuracy of usage. The controls show the greatest increase, however, so that by 22 months of age the controls have both a significantly larger vocabulary and use more words in an appropriate manner.

Turning to the data dealing with the relationship between home stimulation and development, two groups of items appeared to be frequently and consistently related to development. The first group of items appeared at every age level. These items measured such things as noise and activity level in the home, the chances of the child escaping excessive stimulation, and the amount of interpersonal contact the child was exposed to. All of these items seemed to relate to the amount of stimulation the child encountered. At each age level, <u>overstimulation</u> was consistently found to be <u>negatively</u> related to intellectual development as reflected in curvilinear or negative relationships between these items and development. The second group of items considered related to development appeared first at 15 months and appeared also at 18 and 22 months. These items centered around the amount and type of verbal interaction between the mother and child and

were positively related to intellectual development.

Discussion

A number of conclusions can be drawn from the above results. First, these findings indicate the sensitivity of the Infant Psychological Development Scale to early differences in development.

Secondly, the results indicate that infants raised in slum environments will show significantly slower development at a much earlier age than previously suspected. Previous research (Skeels & Filmore, 1937) has shown clear differences in measured intelligence between the deprived and non-deprived child at three years of age and older. The present study seems to indicate that these later deficits are based on earlier differences in intellectual development; differences that appear as early as 11 months and which increase from 18 months on. This widening difference after 18 months is clearly consistent with the research showing measured differences in intellectual performance at three years of age between the deprived and non-deprived child. Though the authors hold to the position that environmental factors, such as degree and nature of stimulation, are the most relevant to these early intellectual deficits, this does not rule out an interaction with other variables for a multi-determined causation. What is indicated is that for a particular "high-risk" group - in terms of later intellective functioning - intellectual deficits are appearing at a very early age indeed. Practically speaking, this may mean that such programs as Head Start may be getting to these "high-risk" children much later in life than they should, perhaps three years too late.

In terms of the environmental factors found to relate to development, the positive relationship of verbal items to development after 15 months is quite consistent with previous research. What is somewhat surprising is the consistent negative relationship of overstimulation items to development. Much discussion has gone on about the slum child as being deprived or understimulated. The present

research suggests that, at least during infancy, environmental overstimulation may be much more detrimental to early intellectual development. As such, these results give tentative support to Kagan's (1 57) recent formulations relating overstimulation to cultural deprivation. What is now needed are smaller, more controlled studies to study the major components of overstimulation and to more precisely specify its effects upon development.

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Footnotes

1 - Because of time limitations, a complete description of the scoring system utilized in this study could not be included in the oral presentation of this paper. However, because of requests for more exact details, this footnote has been included in the written paper. The four point scoring system mentioned in the body of the text was used for the following ability areas: Object permanence; Objects as means; Learning and foresight; Motor imitation. The child's performance on each task of these ability areas was assigned a rating between 2 and 5. (There was an earlier 5 point scale used but for the final scoring, scores of 1 and 2 were collapsed). The meaning of each of these categories is as follows:

5 = Immediate and perfect performance on every trial of the task.

4 = Success on the task but only after one or more failure trials. What constituted a failure had been previously defined for each task. A trial where the child was distracted by extraneous stimuli was not scored.

3 = Partial success on a task. This rating was used only for objects as means and learning and foresight.

2 = Failure on a task.

For statistical analysis (Sign test), each one of the scoring categories was considered as being at a higher level than the category below it. The advantage of this type of scoring system is that it takes into account not only the infant's successes and failures but also the efficiency with which the infant achieved a solution. For Schema development, the dependent variables were the total number of behaviors displayed by the child toward ten objects, the number of different behaviors displayed by the child, the frequency of certain pre-designated behaviors as curiosity, and the level of schema behavior. This last measure was based on the quantitative ordinal scaling of the development of the behaviors measured by this sub-scale. For verbal vacility, the dependent variables were the frequency of the child's verbalizations when objects were presented and the frequency of his appropriate verbal behavior.